

C - Botany- Division C - Rickards Invitational Div. C - 12-05-2020

- **Teams may have the following:**
 - One stand-alone, non-programmable, non-graphing calculator.
 - One hard copy 8.5" x 11" sheets of paper with information from any source. **Electronic notes are fine to use.**
- Partial credit will be awarded accordingly.
- If you are not certain as to what you should be doing, or if a question does not make sense to you, ask the event supervisor what to do.
- For fill-in-the-blank questions, assume your answer to be **singular** unless you're given different instructions.
- Be realistic in all of your answers. Think biologically and environmentally!
- You have 50 minutes to complete this test. Good luck!

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2021 Rickards Invitational: Botany B/C- Answer Key (<https://docs.google.com/document/d/1PsN8gQ3n2tuNiBpzdcTPb8-7U2cypolajZsNSNb0mdU/edit#heading=h.qd1ji0ks00e7>)

1. (1.00 pts) The classification of plants based on their adaptability to adverse climate conditions was created by:

- A) Theophrastus
- B) Valerius Cordus
- C) Carl Linnaeus
- D) Cristen Raunkiær
- E) Charles Darwin

2. (1.00 pts) The German scientist who coined the word "Pharmacognosy" in his work title "Analecta Pharmacognostica" in 1815 was:

- A) C.A. Seydler
- B) Theophrastus
- C) Carl Linnaeus
- D) Joseph Hooker

3. (1.00 pts)

The quote, "Medicine sometimes grants health, sometimes destroys it, showing which plants are helpful, which do harm.", comes from which book:

- A) *Historia Plantarum*
- B) *De Materia Medica*
- C) *De causis plantarum*
- D) *Tractatus de Herbis*

4. (1.00 pts) In water-stress conditions, which plant hormone is responsible for closing of stomata?

- A) Abscisic acid
- B) Gibberellin
- C) Cytokinin
- D) Auxin

5. (2.00 pts) Which of the following constitutes cytokinin function?

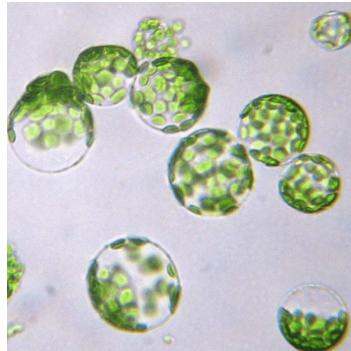
(Mark ALL correct answers)

- A) Stimulates the growth of lateral buds
- B) Stimulation of chlorophyll synthesis
- C) Promotes leaf senescence
- D) Promotes phosphorylation

6. (2.00 pts) Spores and zygotes that develop into whole plants is an example of:

- A) Plasticity
- B) Totipotency
- C) Polyploidy
- D) Multipotency

7. (1.00 pts) The following image shows which of the following:



- A) Chloroplast
- B) Protoplast
- C) Chromoplast
- D) Leucoplast

8. (2.00 pts) Name one enzyme that will prepare a plant cell to look like the above image.

Expected Answer: Cellulase, Pectinase, or Xylanase

9. (3.00 pts) Follow the following plant sequence and recall the term that describes "1", "2", and "3" in order:

- 1. Pollen tube enters the ovule from the micropylar end.
- 2. Pollen tube enters via the integuments.
- 3. Entering of pollen tube from chalaza.

Expected Answer: 1. Porogamy 2. Mesogamy 3. Chalazogamy

10. (2.00 pts) Which of the following auxin in higher concentration is used as selective weedicide?

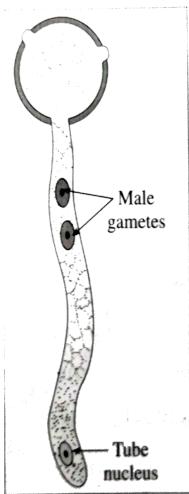
- A) Naphthal acetic acid
- B) 2,4-Dichlorophenoxyacetic acid
- C) N,N diphenyl urea
- D) 2-Naphthoxyacetic acid

11. (2.00 pts) Place of integument origin in plants:

- A) Raphe
- B) Placenta
- C) Endostome
- D) Chalaza
- E) None of the above

12. (3.00 pts)

The following image shows male gametes of an angiosperm traveling from a pollen tube into the female gamete. This was possible via wind-borne pollination. Give the biological terms for the male gametes, female gametes, and this process of plant reproduction.



Expected Answer: 1. Antherozoids or Sperm 2. Egg or Ovum 3. Pollination (Anemophily)

13. (1.00 pts) Let's say there are 20 chromosomes present in a moss plant. What are the number of chromosomes in seta, leaf and calyptra, respectively.

- A) 40, 10, 20
- B) 10, 40, 20

- C) 40, 20, 20
 D) 20, 10, 20

14. (2.00 pts) Name one animal that consumes tubers.

Expected Answer: Bulb weevils, mole rats, pocket gophers, mice, or voles

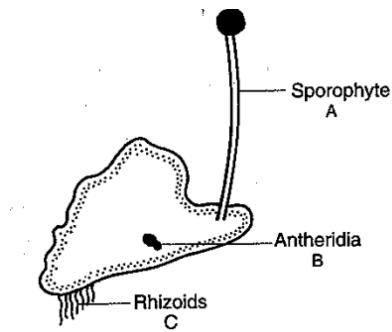
15. (1.00 pts)

Which of the following algae matches this description: Non-differentiated cells, no chlorophyll-a, no phycocyanin within their cells, and no flagellated stages in their life cycles, not made of silica.

- A) Green algae
 B) Brown algae
 C) Red algae
 D) Diatoms

16. (1.00 pts)

The following image is of a random moss. Which of the following ploidy levels is correct based on the indicated structures and your prior knowledge on its life cycle?



- A) A = n; B = 2n; C = n
 B) A = 2n; B = n; C = 2n
 C) A = 2n; B = 2n; C = 2n
 D) A = n; B = n; C = n

17. (1.00 pts) Which of the following descriptions about vascular bundles of monocot stem is correct?

- A) Closed, collateral, endarch vascular bundles
 B) Open, collateral, endarch vascular bundles
 C) Open, collateral, exarch
 D) Closed, collateral, exarch

18. (2.00 pts)

Self-fertilization is undesirable because it limits genetic variation and the possibility for organisms to adapt to certain environments. Surface proteins help recognize similar gametes to avoid such reproduction. So which of the following types of sexual reproduction is being avoided?

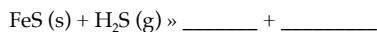
- A) Heterogamy
- B) Oogamy
- C) Isogamy
- D) Polygamy

19. (2.00 pts) Which of the following crops matches this general description: Does not possess an apical bud at the tip and can store starch and glucose.

- A) Tulips
- B) Daffodils
- C) Hyacinths
- D) Dahlias

20. (2.00 pts)

Early organisms on this planet generated energy through chemolithotrophic metabolism, when there was no oxygen present in the soil. The following equation is incomplete. Complete it including the correct **coefficients, subscripts, and states of matter**:



Expected Answer: $\text{FeS (s)} + \text{H}_2\text{S (g)} \rightarrow \text{FeS}_2 (s) + \text{H}_2 (g)$

21. (2.00 pts)

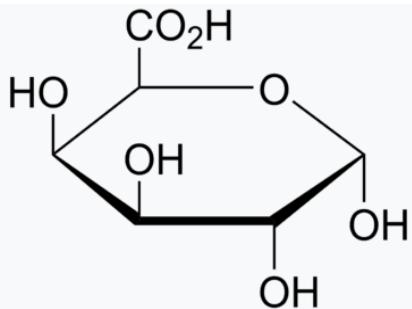
Which of the following choices match the statement: Derived from a flower with a united carpel that splits into two or more one-seeded segments.

- A) Achene
- B) Nut
- C) Samara
- D) Nutlet
- E) Schizocarp

22. (2.00 pts) What is the ratio of Chl-a to Chl-b in chloroplast?

Expected Answer: 3:1 ratio

23. (2.00 pts) The following image is a main component for an edible delicacy:



- A) Uronic acid
- B) D-Galacturonic acid
- C) Acetylneuraminic acid
- D) Xylan

24. (1.00 pts) What percentage of lignin is found in dry wood?

- A) 10%
- B) 20%
- C) 30%
- D) 50%

25. (2.00 pts) How many photons are required for green algae to perform photosynthetic “water-splitting”?

- A) 2
- B) 4
- C) 6
- D) 8

26. (6.00 pts) Which of the following herbicides is selective? **Nonselective**?

- 2,4-Dichlorophenoxyacetic Acid
- Atrazine
- DCMU
- MCPA
- Paraquat
- Glyphosate

Expected Answer: 2,4-Dichlorophenoxyacetic acid is a selective herbicide Atrazine is a nonselective herbicide DCMU is a selective herbicide MCPA is a nonselective herbicide Paraquat is a nonselective herbicide Glyphosate is a nonselective herbicide

27. (1.00 pts) Which of the following describes the importance of flowering:

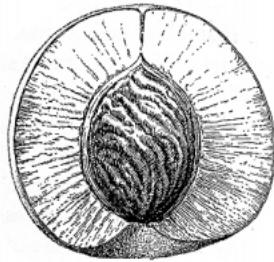
- A) Dispersal of seeds
- B) Forming large number of fruits

- C) Attracting insects for cross pollination
 D) Release of pollen grains

28. (2.00 pts) Which of the following plants reduces hypertension?

- A) *Aconitum chasmantium*
 B) *Solanum nigrum*
 C) *Centella asiatica*
 D) *Rouwolia serpentina*

29. (2.00 pts) Which of the following fruit types describes the following image:



- A) Achenes
 B) Pepo
 C) Drupelets
 D) Drupe

30. (4.00 pts) Describe blanching in terms of vegetable growing, not as a cooking technique. Give one benefit and one con to blanching.

Expected Answer: Blanching is a horticultural technique used to deprive crops of performing photosynthesis so that it can evoke a more delicate flavor and texture however it can also lower a crop's vitamin A levels.

31. (3.00 pts) What agricultural technique has been performed in the following image of a potato farm? Describe the process and how it relates to blanching.



Expected Answer: a. Hilling b. Hilling; burying the normally above-ground part of the plant with soil to promote desired growth and stability against winds. c. Hilling relating to blanching; hillling is a blanching technique where caretakers keep the stems or shoots pale and tender, influencing its taste to be of delicate flavor.

32. (4.00 pts)

Weeds are considered opportunistic and grow when conditions are favorable, such as specific temperatures, lawn moisture levels, bare or thin turf areas, and can even grow in cracks in the roads, sidewalks or driveways.

Describe two cultural practices of creating a weed-free lawn. Spraying herbicides is not a cultural practice.

Expected Answer: a. Keep your lawn dense. By having a thick, full lawn you essentially help "crowd out" the weeds. Weeds grow when there is space for them and a thick lawn reduces available space for the weeds to grow in. Any bare or thin areas at the end of the season should be seeded in the early fall (September) of each year to thicken up the turf density. b. Mow regularly and keep the grass blades high. It is recommended that the grass be kept at 3 – 3 ½ inches in length. Remove the top 1/3 of the grass blade at a time per mowing. This helps shade the soil underneath the grass canopy, which in turn helps reduce weed growth. Mow when the lawn needs to be mowed. Do not mow just because the lawn gets cut every Wednesday. Also, avoid scalping of the lawn by driveways, walkways, patios etc. with a weed wacker or trimmer. If the edges get cut too short they die off, causing the grass to thin back creating bare soil and an opportunity for the weeds to grow in that area.

33. (2.00 pts) Identify the following image and be as specific as you can: oscillating hoe**34. (2.00 pts) Identify** the following disease in this image:



Dollar

spot

35. (2.00 pts) Describe its causation and how it's spread.

Expected Answer: Clarireedea infects turf and professional landscapes by producing mechanically-spreading mycelium. Underfertilizing, excessive moisture, drought stress and thatch leave grasses susceptible are some causations. Invasion happens when the mycelium penetrates new leaves if moisture is sufficient in the turf canopy.

36. (2.00 pts) Which of the following disease is caused by bacteria?

- A) Apple scab
- B) Curly top
- C) Dutch elm
- D) Aster yellows

37. (4.00 pts) Study the following lists and **match** them correctly:

- | | |
|-------------------------------|--------------------------------|
| A. Siphonogamy and zooidogamy | I. Amphibians of plant kingdom |
| B. Fossil (living) | II. Peanuts |
| C. Liverworts | III. Ginkgo |
| D. Double fertilization | IV. Cycas |
| | V. Laminaria |

Expected Answer: A- IV B- III C- I D- II

38. (2.00 pts) What agricultural technique is the farmer performing throughout her potato farm?

 flame weeding

39. (1.00 pts) Which of the following is a living simple tissue involved as strengthening tissue for the plant body?

- A) Parenchyma
- B) Endodermis
- C) Collenchyma
- D) Cambium
- E) Pericycle

40. (2.00 pts) The channels of protoplasm that exists through cell walls that connect one cell to another and function like gap junctions are:

- A) Stomata
- B) Guard cells
- C) Amyloplasts
- D) Middle lamellae
- E) Secondary wall

41. (1.00 pts) The initiation of seed germination requires:

- A) Guttation
- B) Transpiration
- C) Phototropism
- D) Imbibition
- E) All of the above

42. (1.00 pts) Cacti have traditional leaves just like any typical angiosperm does.

- True
- False

43. (2.00 pts) Identify the disease seen in the following image:



chlorosis

44. (2.00 pts)

You noticed this disease in the leaves of your apple plants and suspect that there is a bacterial infection affecting the plant's vasculatures. **Which** vasculature system is predominantly affected and **why**?

Expected Answer: Phloem During infection, the pathogen tries to invade the plants by producing chemicals. During this chemical war, chlorophyll pigment is denatured. In response, the cell starts to avoid the spreading of pathogens and even programmed cell death will occur. Phloem is the vascular system affected much since it has more glucose in its sap, affecting photosynthesis.

45. (2.00 pts) Select the true statement(s) about the nitrogen cycle.

(Mark **ALL** correct answers)

- A) When plants and animals die, nitrogen is removed from the nitrogen cycle.
- B) The nitrogen cycle requires different types of bacteria.
- C) Nitrogen gas is converted to nitrates in plant leaves.
- D) Nitrogen cannot be cycled through living organisms.

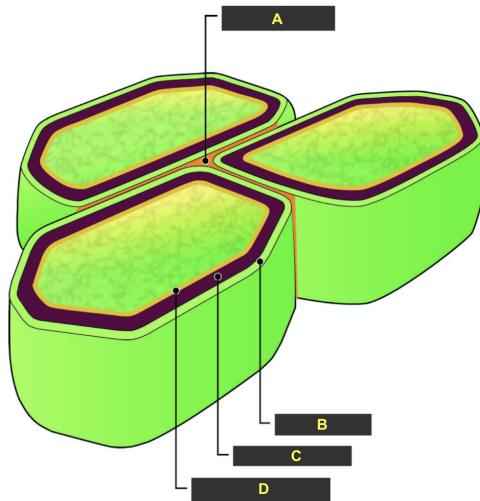
46. (2.00 pts) Describe how do maize and orchids decrease their incidence of photorespiration.

Expected Answer: (PEP) Carboxylase has a higher affinity for carbon dioxide than Rubisco and serves to fix carbon dioxide into an organic intermediate molecule. The presence of PEP Carboxylase in C4 and CAM plants reduces photorespiration. Both C4 and CAM plants ultimately release carbon dioxide from organic intermediates to the Calvin Cycle and Rubisco, but avoid photorespiration by sequestering the Calvin Cycle out of the way of oxygen. The CAM plants are well adapted to dry environments, opening their stomata at night to fix carbon dioxide into organic intermediates. The carbon dioxide is stored in organic intermediates through the night, and is then released to the Calvin cycle in the morning as the light comes up. By the morning, the stomata are closed and [CO₂] within the cells will be much higher than oxygen. Photorespiration will be reduced as carbon dioxide does not bind to Rubisco's active site.

47. (6.00 pts) List and describe four categories of plant disease symptoms based on your knowledge on phytopathology.

Expected Answer: 1. Wilting: Wilt is caused by drought stress. If a pathogen obstructs the uptake of water by the host plant, a part of the plant or the whole plant will eventually die. Wilt is caused by fungal genera like *Vetricillium* and *Fusarium* and bacterial species like genus *Xanthomonas*. These species colonize in the xylem of plants which will result in obstruction of water transport. 2. Defoliation: With the progression of infectious disease, the plant will eventually lose its leaves and at times drop its fruit. Defoliation is a common symptom in sycamore anthracnose which is caused by *Gnomonia veneta* and apple scab which is caused by *Venturia inaequalis*. 3. Dwarfing: Some diseases lead to decrease in cell numbers or cell size, stunting few or all parts of the host plant. 4. Abnormal increase in tissue size: In few cases, certain diseases increase cell numbers or cell size in plant tissues, twisting and curling the leaves or forming galls on stems or roots.

48. (2.00 pts) Identify "A", "B", "C", and "D" as seen in the following image of adjoining plant cells:

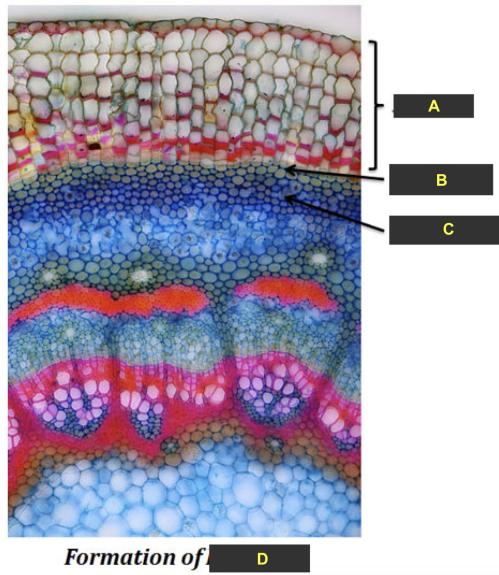


Expected Answer: A- Middle Lamella B- Primary cell wall C- Secondary cell wall D- Plasma membrane or cell membrane

49. (2.00 pts) Which of the following elements is present in "A"?

- A) Zn
- B) Ca
- C) Cu
- D) K

50. (4.00 pts) Identify "A", "B", "C", and "D" as seen in the following image of a vascular plant tissue sample:



Expected Answer: a. Phellem (cork) b. Phellogen (cork cambium) c. Phelloiderm d. Periderm

- 51. (3.00 pts)**
- Which defined letter gives rise to cork tissues.
 - Give two items that are made from *Quercus suber*.

Expected Answer: Identification- B or Phellogen Example 1- Wine bottle stoppers Example 2- Coasters

- 52. (1.00 pts)** Which of the following plant cell organelles is responsible for drug detoxification and a site for lipid synthesis?

- A) Smooth ER
- B) Rough ER
- C) Golgi Apparatus
- D) Mitochondrion

- 53. (3.00 pts)** What does VAM stand for?

Vesicular

Arbuscular

Mycorrhizal

People in your town complain about how **some** of their local pineapples and papayas tasted **candied** (sugary/syrupy), not rich in **honey**. You are concerned about this and therefore conduct an experiment that tests to distinguish between the honey-processed pineapples and papayas versus the supposed sugar-processed pineapples and papayas. To start, you personally order a batch of 100 pineapple and papaya samples (possibly mixed) from the Malaysian company with approval from the U.S. Customs Service. You also have tabular values of C₃, C₄, CAM plants (e.g. sugarcane, corn) to refer to when drawing your conclusion.

Materials:

- Mass spectrometer
- Papayas and Pineapples
- EtOH (Ethanol)
- Blender
- Vacuum oven
- Cutting utensils and measuring equipment

- 54. (8.00 pts)**
- What type of carbon metabolism do pineapples and papayas function in (C₃, C₄, CAM)?
 - Describe how this relates to **facultative CAM**.
 - Describe what you are biologically comparing in your experiment to determine the validity of your local honey-processed fruits.
 - Describe how you will conduct this experiment.

Expected Answer: a. Pineapples, CAM, Papaya, C3 b. Facultative CAM or inducible CAM is a process in which a plant brings upon a C3 or C4 metabolic function to make the CAM process optional to use. This is relevant because it goes to show how pineapples are not 100% CAM. c. Based on the given materials, notably the mass spectrometer, you are biologically comparing the carbon dioxide fixated between candied fruits vs. honeyed fruits by analyzing carbon isotopes. Credit:
<https://digital.libraries.psu.edu/digital/collection/honeyboard/id/57/>

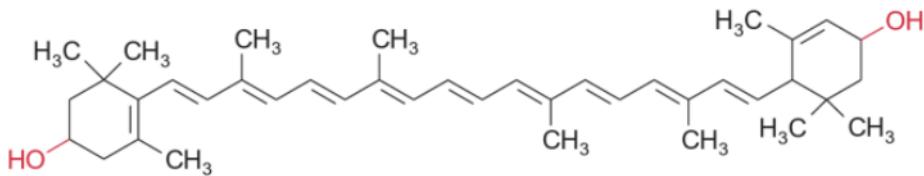
- 55. (2.00 pts)** Describe one benefit and one issue behind knockdown herbicides.

Expected Answer: Benefit; Use of non-selective or knockdown herbicides can enhance the timeline of sowing (planting with seed). Issue; The overuse of non-selective or knockdown herbicides goes with resistance.

- 56. (4.00 pts)**
- What are LHC's?
 - What are they mostly made out of?
 - Explain why Photosystem I has fewer LHC's than Photosystem II.

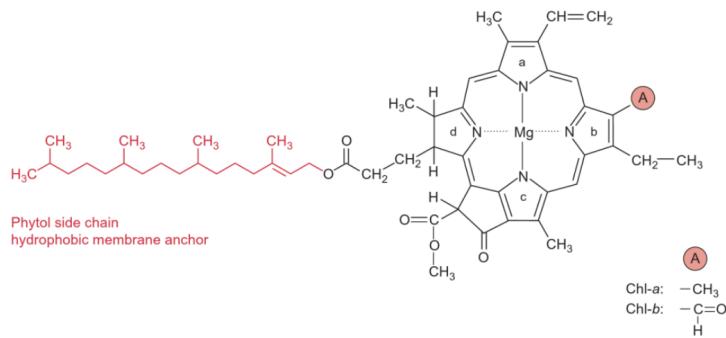
Expected Answer: a. LHC's are light harvesting complexes, the antennae of plants, collects light particles. b. LHC's are mostly made out of LHC polypeptides and chlorophylls that are encoded by the nucleus. c. PS I has fewer LHC's than PS II because its core antenna is larger, core complexes or that light hits PS II before PS I, making the required use of PS less demanding.

- 57. (2.00 pts)**
- Identify the following compound.



Expected Answer: Identification- Lutein (xanthophyll)

58. (2.00 pts) The basic structure on the left formed by combined chlorophyll-a and chlorophyll-b rings below is called?



Expected Answer: Identification- Tetrapylorre or Porphyrin

59. (3.00 pts)
- Identify the type of derivatives formed by lignin polymerization.
 - Give two examples.

Expected Answer: Identification- Phenylpropane Example 1- Cumaryl alcohol Example 2- Coniferyl alcohol

60. (2.00 pts)

Isolated from neighboring tissue, these plant cells are known to potentially contain poisonous CaC_2O_4 . **Answer written in plural form. Do not include the word "cell" or "cells" in your answer.**

Idioblasts

61. (2.00 pts) What is the edible item from **Question 23** that some consume for breakfast?

Expected Answer: Example- Jams or Jelly or Milk

62. (4.00 pts) Contextualize the following floral formula:

- What does each letter and number represent and mean?
- What does the curved line represent?

A⁵G₂

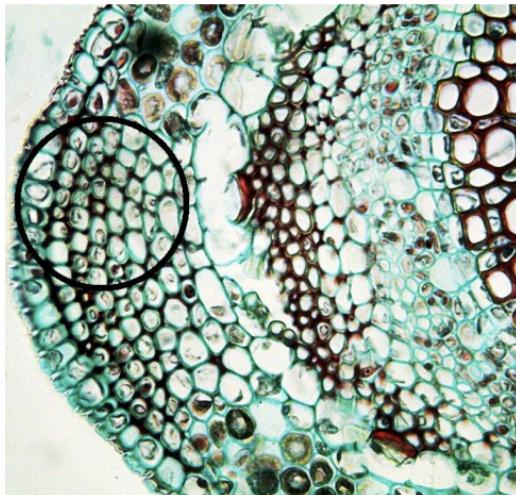
Expected Answer: Androecium and gynoecium fused by their upper parts. 5 stamens and 2 pistils.

63. (10.00 pts) Interpret the following floral formula: $\% \varnothing K_3 C_4 A_{(2+2)} G_{(2)}$

Hint: Go from left to right, denoting all adjacent letters, numbers, and symbols. Use individual and collectively-named plant parts when needed.

Expected Answer: Flower zygomorphic, hermaphrodite, calyx of 3 separate sepals, corolla of four separate petals, androecium of 4 stamen (2 in one set fused another 2 in one set), superior fused gynoecium bicarpellate (or pistils).

64. (2.00 pts) Identify the type of plant cells based on the following image (Do not include the word “cell” or “cells” in your answer):



Collenchyma

65. (2.00 pts) Describe how the xylem will stop water transportation if needed right before the winter season arrives.

Expected Answer: Dead cells are useful but hard to control. However, if xylem transport needs to be decreased, there is a way. Xylem parenchyma cells will make tyloses ("stoppers") which will grow into dead tracheary elements and stop water if needed. Many broadleaved trees use tyloses to lower xylem transport before the winter.

66. (2.00 pts) Hypothesize why tubers, a type of stem modification, arose in our natural environment.

Expected Answer: To get through stressful periods of drought or freezing - which is effectively drought, too, as frozen water's useless to roots. The impressive variety of solutions is testimony to the power of natural selection.

67. (2.00 pts) What are the small white growths as seen in the following image?



Expected Answer: Cormels or bulbo-tuber or bulbotuber

The following image pertains to this xylem/phloem differentiation chart.

Word Bank: Sugar, Water, Up, Down, Small, Big.

68. (6.00 pts)

	Xylem	Phloem
Contains mostly	Dead cells	Living cells
Transports	1	4
Direction	2	5
Biomass	3	6

- Identify "1", "2", "3" using the Word Bank.
- Identify "4", "5", "6" using the Word Bank.

Expected Answer: Must correctly identify "1", "2", and "3" to earn the point: Water, Up, Big Must correctly identify "4", "5", and "6" to earn the point: Sugar, Down, Small

- Congratulations, you have finished the botany examination.
- Feel free to fill out this test feedback survey: tinyurl.com/RateMySciolyTests (<http://tinyurl.com/RateMySciolyTests>).
- Email: mayurchhitu@gmail.com